Ontario's PhD Graduates from 2009: Where are they now?

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Executive Summary

The government of Ontario has signalled the need to expand graduate education to create and sustain a highly skilled workforce in today's knowledge-based economy. Ontario has grown its PhD capacity deliberately since 2005, beginning with its *Reaching Higher* initiative, to produce highly qualified personnel to work both inside and outside academia.

This expansion has fuelled a debate as to whether we are now producing too many or not enough PhD graduates. There is also growing concern that job opportunities for PhD graduates are softening. In response to these concerns, we conducted an internet-based search to identify where all 2,310 graduates who earned a doctorate from an Ontario university in 2009 are currently working.

Just under 30% of Ontario's PhD graduates from 2009 are full-time tenure or tenure-track professors at a university. Another 21% have other jobs within academia – jobs like researchers, lecturers, college instructors and administrators. Thirty-five percent are employed outside academia in a variety of sectors. Key industries are: health care, government, professional and scientific services (engineering companies, scientific research and consulting), and manufacturing. We were unable to find employment information for the remaining 15% of graduates. They are likely employed outside academia, unemployed or are out of the labour force entirely.

Just under half of Ontario's PhD graduates from 2009 are working in Ontario. Of the balance, one-third are working elsewhere in Canada, one-third in the United States and one-third in another country around the world. Those working as a university professor were the most mobile: about half (53%) are working at a Canadian university, 16% in the United States and 31% in another country.

Over half of Ontario's PhD graduates from 2009 earned their PhD in a STEM- (science, technology, engineering and math) related discipline. These graduates are more likely to be employed outside academia compared to humanities, social science and business graduates.

There were slightly more male PhD graduates than female. Male and female graduates are working in similar industries and sectors. Ontario universities have hired an equal number of male and female graduates of our cohort as professors.

Four out of five graduates earned their PhD from a research-intensive university in Ontario. Ontario's research-intensive universities are producing competitive PhD graduates: one out of every ten of their graduates who are working as a university professor are doing so at a top-ranked university in the world.

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Introduction

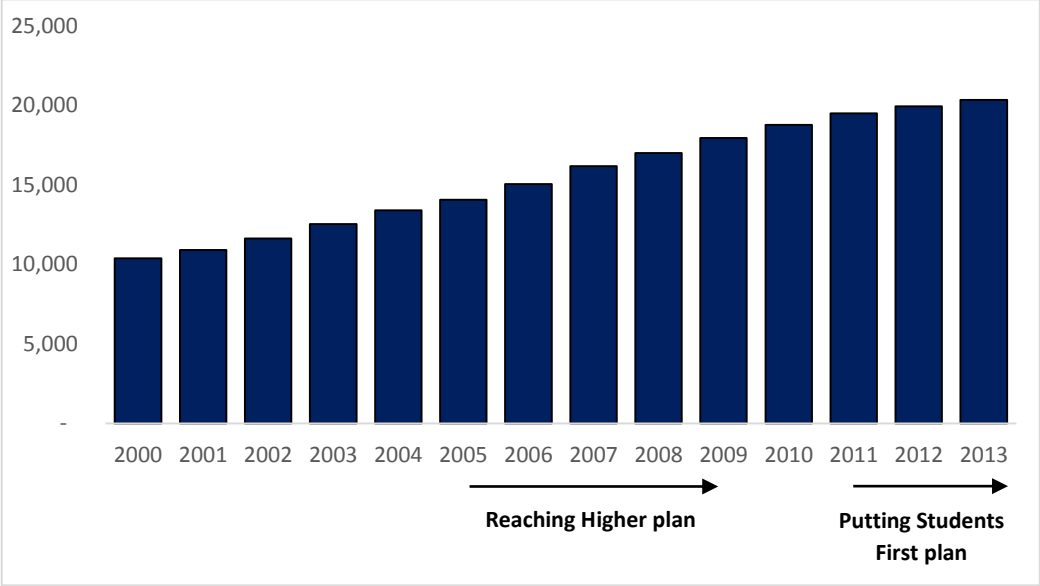
Ontario's PhDs by the Numbers

Over the past decade, graduate student expansion has been a priority for the Ontario government. Substantial investments have been made to expand professional and research-based graduate programs for two purposes. The first was to ensure an adequate supply of faculty during a period that saw enrolment growth combined with the expectation of increasing faculty retirements. The second was to develop a highly educated and skilled workforce to help drive innovation and wealth creation in the province.

In 2005, the Ontario government announced funding for 14,000 additional graduate student spaces by 2009-10 as part of the Reaching Higher plan (Ontario Budget, 2005). Again in 2011, the government announced 6,000 additional spaces targeted towards master's and PhD students to be created by 2015 through the Putting Students First plan (Ontario Budget, 2011).

As a result of the government's ongoing commitment to expand graduate education, Ontario's PhD enrolment has nearly doubled over the past 15 years (Figure 1). By 2013, there were over 20,000 students enrolled in a doctoral program in Ontario.

Figure 1: Ontario's PhD Enrolment (headcount) from 2000 to 2013



Source: Statistics Canada, Postsecondary Student Information System (PSIS) – CANSIM table 477-0019

Why PhDs Matter

In his influential 2005 review of higher education in Ontario, Bob Rae stated that "An immediate start to graduate expansion is imperative: double-cohort undergraduates are graduating. Ontario is facing a faculty shortage due to retirements, and the province needs to close the productivity gap with competing jurisdictions" (Rae, 2005; see also Maldonado, Wiggers & Arnold, 2013.)

The double cohort, which intensified the call for faculty renewal, refers to the fact that in 2003 Ontario eliminated grade 13 and thereby graduated a larger than normal class of undergraduates starting in 2007. That year saw two waves of high school graduates entering Ontario universities simultaneously, one from the new grade 12 exit point and one from the final class of grade 13 graduates. The government had invested in an expansion of undergraduate capacity in 2003, and it was now time to address the expansion of graduate spots for these students.

At the same time, the need for more PhDs to supply the Ontario economy with highly qualified personnel was also gaining prominence. An influential voice in this regard was (and is) the Task Force on Competitiveness, Productivity and Economic Progress, launched and funded by the Ontario government in 2001. Beginning with its first annual report in 2002, over the course of a decade of research the task force called repeatedly for graduate expansion to increase economic competitiveness. A chart showing under-enrolment in Ontario at the master's and PhD levels compared to peer jurisdictions was reissued in several of its publications. The following quote from its 2011 report summarizes the overall argument:

> **Why degree attainment matters:** Over the years, our work has shown that postsecondary education is an important element of our innovation, productivity, and prosperity progress – for individuals, firms, and jurisdictions. More education directly correlates with higher lifetime earnings and lower unemployment. International research by the OECD shows a positive and significant relationship between years of schooling and per capita growth in output. A more educated management cadre is associated with stronger management capabilities. And there is a strong correlation between labour force quality and per capita economic growth rates. To the extent we have a highly educated workforce, Ontario will thrive as globalization advances. (Task Force on Competitiveness, Productivity and Economic Progress, 2011, p. 37)

While PhD graduates do in fact experience favourable labour market outcomes and are actively engaged citizens, the recent expansion in graduate capacity has fuelled a debate about whether we are now producing too many PhD graduates (Iqbal, 2012) or not enough (Brouwer, 2016; Conference Board of Canada, 2010). There is also a growing concern that PhD graduates cannot find jobs, especially in academia (Dehaas, 2014; Sekuler, 2014; Fullick, 2013). To determine whether we are educating the optimal number of PhD graduates, we should start by asking what we actually know about the fate of PhD graduates, especially their labour market outcomes.

A better understanding of the employment outcomes of Ontario's PhD graduates is essential for government, universities and students. It is important to know which sectors and occupations hire Ontario's doctoral graduates to determine whether the intended outcome of producing highly skilled individuals to help drive the economy is being fulfilled. It is equally important to examine the extent to which our graduates leave Ontario and Canada altogether after graduation. A better understanding of which employers are hiring our PhD graduates, whether in Canada or abroad, can highlight valuable opportunities for universities and students to better align themselves with the needs of the domestic and global workforce.

What Do We Know about PhD Graduate Outcomes?

A number of data sources in Canada and the United States tell us something about how PhD graduates fare.

Previous research by HEQCO has examined the social and private returns to higher education. Individuals with a higher level of education are generally happier, healthier and wealthier compared to those with a high school education (Weingarten et al., 2015; Hicks & Jonker, 2015; DeClou, 2014; HEQCO, 2013).

Results from Statistics Canada's National Graduate Survey (NGS) show that Ontarians and Canadians with a doctoral degree have consistently experienced more favourable labour market outcomes. The NGS is a longitudinal survey, run every four to five years since 1982, that collects information on employment rates, earnings and job relatedness to field of study for Canadian postsecondary graduates. The NGS surveys graduates who are residing in Canada or the United States at the time of the survey. Each cohort of college and university graduates is interviewed two[1] and five years after graduation. Doctoral graduates consistently report high employment rates and the highest median earnings[2] (Ferguson & Wang, 2014).

Statistics Canada's Survey of Earned Doctorates (SED) also collected information on labour market activities post-graduation. The SED was an annual census of doctorate recipients in Canada that was conducted from 2003-04 to 2007-08. The survey collected detailed information on demographic and educational characteristics, funding sources and immediate post-graduation plans. Seven out of 10 graduates from the first three cohorts of graduates (2003-04, 2004-05 and 2005-06) had definite plans for work (either a contract had been signed or graduates were returning/continuing with the same employer/position that they held prior to graduation) or postdoctoral studies or research (King, Eisl-Culkin & Desjardins, 2008). Further results from the 2005-06 cohort show that of the graduates with definite employment plans, 50% planned to be employed at a Canadian postsecondary institution, 21% reported plans to be working for an industry or be self-employed, 11% intended to work in government and 18% for another type of employer.

Desjardins and King (2011) linked results from the NGS and SED for the 2005 cohort of doctoral graduates to examine whether expectations about post-graduation plans matched up with employment results two years after graduation. Industry of employment varied across discipline, but doctoral graduates overall were employed in a small cluster of industries. The majority of doctoral graduates were employed in educational services (56%), professional, scientific and technical services (14%), and health care and social assistance (14%). The humanities and "education and other" fields had the highest percentage of graduates who had definite plans to work in educational services (77% and 76% respectively), which includes academic careers, while graduates from engineering had the smallest (34%).

[1] With the exception of the 2009 cohort, which was interviewed three years after graduation.

[2] These findings are consistent with data from Statistics Canada's Labour Force Survey (CANSIM table 282-0004 – Labour Force Survey Estimates, by educational attainment, sex and age group, annual) and the National Household Survey (Edge & Munro, 2015).

A recent study by the Conference Board of Canada (Edge & Munro, 2015) examines where Canada's PhDs are employed using data from the National Household Survey. The authors examine the occupations and sectors in Canada that employ individuals between the ages of 25 to 64 who hold a PhD. Nearly 40% of Canada's PhDs are employed in the postsecondary education (PSE) sector, with 18.6% employed as a full-time university professor. The remaining 60% of Canada's PhDs are employed in a variety of other sectors, including natural and applied sciences (17%), health (11%), "education, law social community, government services" (11%) or another industry (21%).

In the United States, the National Science Foundation conducts two surveys of doctorate graduates from American academic institutions. The first is the annual Survey of Earned Doctorates (SED), which has been conducted since 1957. Many questions from the Canadian SED are modeled on the American version of this survey. The second is the Survey of Doctorate Recipients (SDR), which is a panel study conducted every two years since 1973 targeted at graduates who received a research doctorate in a science, engineering or health field. The survey collects information on demographics, educational characteristics and career history (including information on job title, job description, employer information, and tenure status and faculty rank if working at an educational institution). The surveys consistently indicate that roughly half of all doctoral graduates either plan to work in academia or are working in academia after graduation (National Science Foundation, 2015; Chang & Milan, 2014)

Various institutions in the US track their PhD graduates through the use of a survey or an internet search. The results consistently indicate that a high proportion of PhD graduates from these institutions are employed at a postsecondary institution after graduation.

Duke University collected employment information for 3,046 PhDs who graduated between 2003-04 and 2012-13. Of these, 59% were employed in an academic role,[3] with 27% of graduates employed in an academic tenure-track position. Graduates from the humanities and the social sciences had the highest proportion of PhD graduates who are employed in an academic role compared to graduates from engineering and biological sciences.

Stanford University conducted an Alumni Employment Project in 2013 that tracked employment outcomes of 2,420 Stanford PhD graduates from two cohorts – a ten-year cohort (including graduates who earned their PhD in 2002, 2003 or 2004) and a five-year cohort (graduates who earned their PhD in 2007, 2008 or 2009). The study collected information on initial and current employment sector, job titles and the employers who hired Stanford PhDs. Forty-one percent of PhD graduates were employed in an academic role[4] five years after graduation, with 21% employed in a tenure-track position. This percentage increased to 45% 10 years after graduation, with 29% of graduates employed in a tenure-track position.

The University of Pennsylvania conducted a PhD alumni survey of graduates who earned a PhD between 1998 and 2003. The response rate was 40%. Pennsylvania found that 57% of its PhD graduates who

[3] An academic role includes academic tenure-track, academic non-tenure-track and postdoctoral fellowships.
[4] An academic role includes the following: tenure-track and non-tenure track positions, postdoctoral fellowships, "other academic" roles, and graduates who are employed at a non-US university.

responded to the survey were currently employed in the higher education sector, with the vast majority of these graduates working as a professor (80%).

Other researchers in the US have attempted to track employment outcomes for PhD graduates for a particular field of study across a number of different universities. The American Historical Association conducted an internet-based research project on a random sample of 2,500 PhD graduates from history (from a sample pool of 10,976) from May 1998 to August 2009. The Modern Language Association (MLA) of America surveyed doctoral graduates from 2006-07 from an English or modern language program in the US and in Canada one year and two years after graduation. Both studies found a high proportion of graduates who were employed at a postsecondary institution at the time of the study. Seventy-one percent of history PhD graduates were employed in the postsecondary sector, with 51% of all history graduates employed in a tenure-track position at a four-year institution (Wood & Townsend, 2013). Eighty percent of PhD graduates from an English or modern languages program were employed at a postsecondary institution,[5] with 55% of all graduates working in a tenure-track position two years after graduation (MLA, 2011).

Zolas et al. (2015) examined earnings and job placement outcomes for PhD graduates who were supported by funded research from eight universities across the US (Indiana, Iowa, Michigan, Minnesota, Ohio State, Purdue, Penn State and Wisconsin). The authors found that over half of doctoral recipients who left the university between 2009 and 2011 were working in academia between 2010 and 2012.

While existing data sources highlight important employment outcomes of PhD graduates in North America, our study focuses on recent graduates who completed a PhD at a university in Ontario.

This Study: Ontario's PhD Graduates from 2009

To identify where Ontario's recent PhD graduates are employed, we tracked all 2,310 graduates who earned a doctorate from an Ontario university in 2009. We used convocation materials to construct a list of graduates by university and field of study. This includes both international and domestic students and we did not (and could not) distinguish between them.[6] We included graduates who earned a research-based doctoral degree. We used a variety of search techniques on the World Wide Web to discover where they are and what they are doing in 2015. Through this internet-based approach, we collected information on employment characteristics (job title, employer name, employer country) and gender for each graduate in our sample.

Our approach differs from the recent Conference Board of Canada study (Edge & Munro, 2015), which examined outcomes for Canada's PhD graduates regardless of whether their degree was obtained in Canada or abroad. We focused only on graduates from Ontario universities. We further identified employment information for the 2009 cohort of graduates regardless of the country in which they are working, whereas the Conference Board examined those living in Canada.

[5] Includes the following: tenure-track positions, renewable non-tenure track appointments and one-year term (or terms of unknown length) non-tenure-track appointments.

[6] Using data from Statistics Canada's Postsecondary Student Information System (PSIS), we found that 38% of doctoral graduates from Ontario in 2009 were international.

Through our web-based search, we identified employment information for 85% of our sample. This yielded a significantly higher response rate than either the National Graduate Survey or the Survey of Earned Doctorates, which had response rates of 49% and 51% respectively for their most recent iterations. Since our method of determining employment status did not require the cooperation or self-identification of graduates, we minimized the effects of self-selection bias and non-response bias that are typically prevalent in surveys.

We selected the 2009 cohort for three reasons. First, graduates are more likely to be settled into a career six years after graduation. Second, the most recent results from the National Graduate Survey (NGS) are also based on the graduating class of 2009-10. The results from the NGS complement our analysis by providing additional information on measures such as employment rates and earnings three years after graduation for our cohort of PhD graduates.[7] Third, 2009 was a recessionary year, providing a good test of job prospects for PhD graduates in a challenging overall job market.

Organization of the Findings

The body of this report is organized as follows:

Section A: The PhD Class of 2009. How many graduated from each Ontario university, and what was the distribution of graduates by discipline and gender?

Section B: Where Are They Now? An analysis of graduates' employment status in 2015 within three categories (professors, other jobs inside academia and jobs outside academia), and where they live.

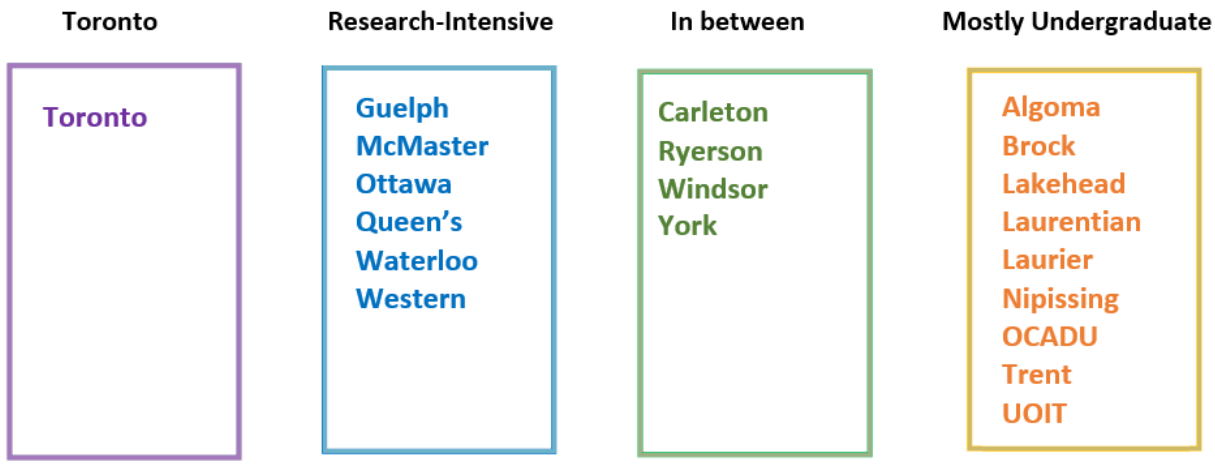
Section C: Additional Analysis of Employment Outcomes. For professors: analysis of the locations and prestige of the universities that hired them. For other jobs in academia and jobs outside academia: additional detail about the varieties of jobs and industries in which they work.

Part A: The PhD Class of 2009

How Many Graduated from Each University?

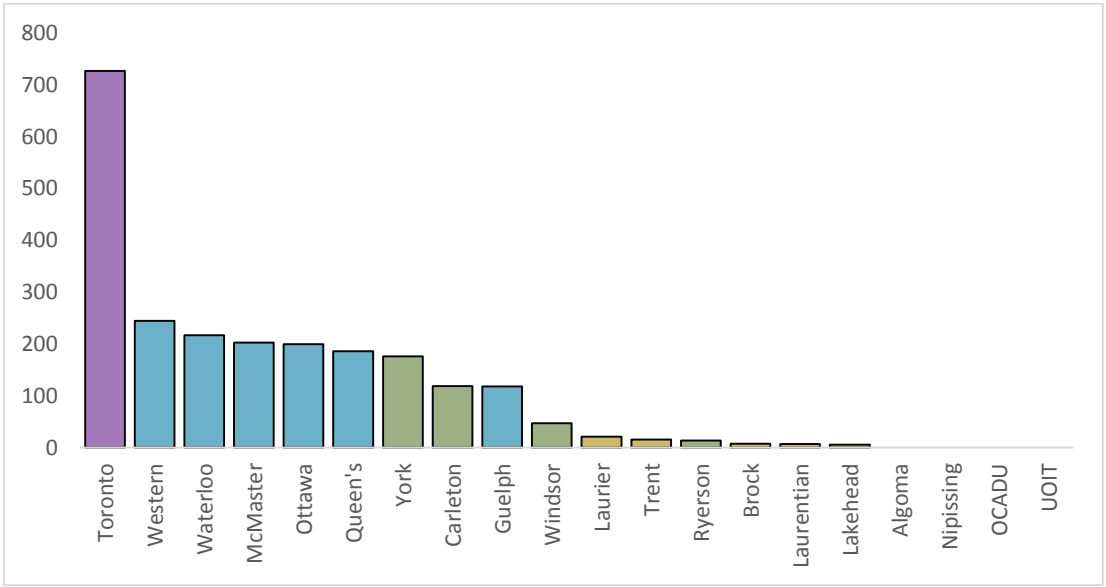
We assembled our list of 2,310 PhD graduates from the convocation programs published by Ontario's universities in 2009. Figure 2 shows the number of PhD graduates by university. We colour-code universities on the basis of the clusters identified in HEQCO's 2013 publication, *The Diversity of Ontario's Universities: A Data Set to Inform the Differentiation Discussion.*

[7] Results from the NGS indicate that three years after graduation, 91% of Ontario's doctoral graduates from 2009-10 were employed, with 85% working full-time. Median full-time earnings were $80,000.



Collectively, the University of Toronto and Ontario's research-intensive universities awarded 82% of all doctoral degrees in the 2009 calendar year. There were no doctoral degrees awarded at Algoma, Nipissing, OCADU and UOIT.

Figure 2: Number of Ontario's PhD Graduates from 2009 by University



Distribution of Graduates by Field of Study

To aggregate the data for all of Ontario and make comparisons across field of study, we categorized disciplines using Statistics Canada's Classification of Instructional Programs (CIP) scheme for consistency. The following graph shows the percentage of PhD graduates by field of study for the graduating class of 2009. Just over half earned their PhD in a STEM-related discipline (includes sciences, math and computer science, engineering and agriculture). The "other" category includes graduates from

multidisciplinary studies. For more information on these field of study categories, please refer to Appendix 1.

Figure 3: Percentage of Ontario's PhD Graduates from 2009 by Field of Study

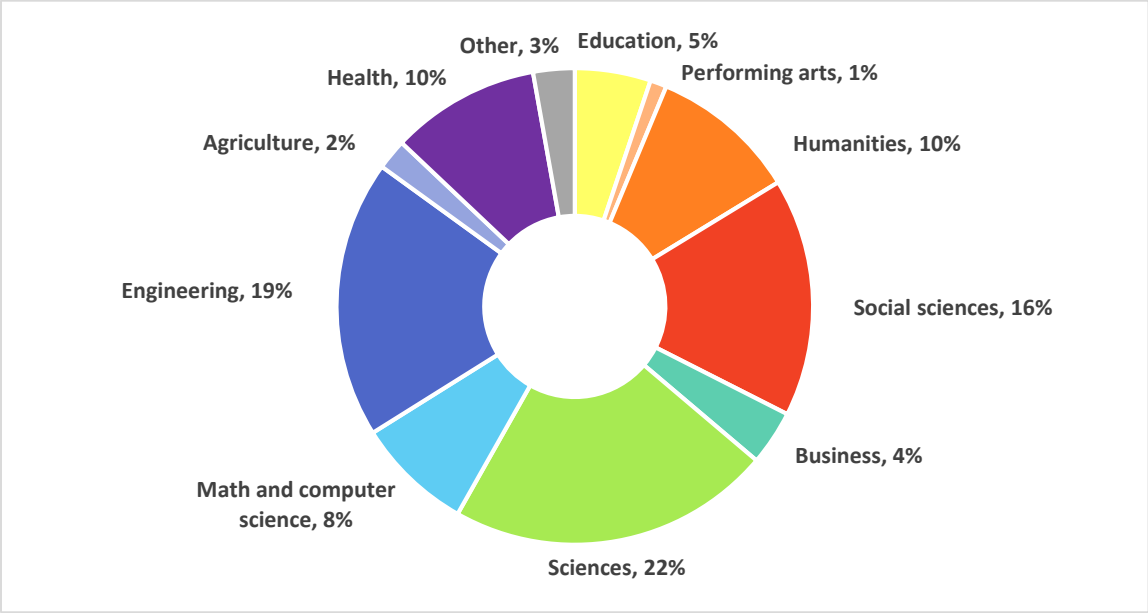


Table 1 shows the distribution of graduates by field of study and university. Universities are sorted on the basis of the share of graduates who earned their PhD from a STEM- or health-related discipline (from highest to lowest). PhD graduates from Brock, Lakehead, Laurentian, Ryerson and Trent are grouped together in the "Rest of Ontario" category due to small sample sizes (less than 15 graduates). Ontario's research-intensive universities have a higher proportion of graduates who earned their PhD in a STEM- or health-related discipline.

Table 1: Distribution of Graduates by University and Field of Study

	# PhDs	STEM + Health										
		Sciences	Math and CS	Engineering	Agriculture	Health	Education	Performing arts	Humanities	Social sciences	Business	Other
Waterloo	217	20%	19%	41%	0%	7%	0%	0%	2%	6%	5%	1%
Guelph	118	38%	7%	3%	25%	8%	0%	0%	3%	14%	0%	3%
Western	245	26%	8%	23%	1%	13%	2%	1%	8%	10%	8%	1%
Windsor	47	28%	6%	32%	2%	0%	6%	0%	0%	26%	0%	0%
McMaster	203	21%	4%	24%	0%	17%	0%	0%	11%	19%	3%	0%
Queen's	186	20%	11%	25%	0%	5%	3%	2%	11%	12%	3%	9%
Ottawa	200	35%	8%	17%	0%	1%	4%	0%	20%	13%	0%	3%
Carleton	119	18%	8%	31%	0%	0%	0%	0%	3%	29%	7%	4%
Toronto	727	18%	7%	13%	1%	18%	12%	2%	12%	11%	3%	2%
Rest of Ontario	51	14%	0%	27%	8%	2%	8%	0%	0%	20%	0%	22%
York	176	18%	5%	0%	2%	2%	5%	2%	11%	50%	5%	0%
Laurier	21	0%	0%	0%	0%	0%	0%	0%	38%	43%	19%	0%
Ontario	**2,310**	**22%**	**8%**	**19%**	**2%**	**10%**	**5%**	**1%**	**10%**	**16%**	**4%**	**3%**

Note: Rest of Ontario includes Brock, Lakehead, Laurentian, Ryerson and Trent

Distribution of Graduates by Gender

There were slightly more male PhD graduates compared to female in the graduating class of 2009. From our sample of 2,310 graduates, 50% are male, 42% are female, and we were unable to find gender information for the remaining 8%. There was a higher proportion of males who earned their PhD in a STEM-related discipline, most notably in engineering or math and computer science. There was a higher proportion of females who earned their PhD in the social sciences, education and performing arts.

Table 2: Percentage of Ontario's PhD Graduates from 2009 by Field of Study and Gender

	Females	Males	Unknown
Education	63%	34%	3%
Performing arts	77%	23%	0%
Humanities	51%	46%	3%
Social sciences	61%	35%	3%
Business	44%	51%	5%
Sciences	39%	50%	10%
Math and computer science	20%	64%	15%
Engineering	18%	69%	13%
Agriculture	38%	54%	8%
Health	53%	44%	3%
Other	52%	46%	2%
All programs	**42%**	**50%**	**8%**

Part B: Where Are They Now?

From our sample of 2,310 graduates, we identified 11 graduates who were not part of the labour market in 2015 (i.e., graduates who passed away or who identified as being retired or pursing further studies). We removed them the following analysis of employment outcomes.

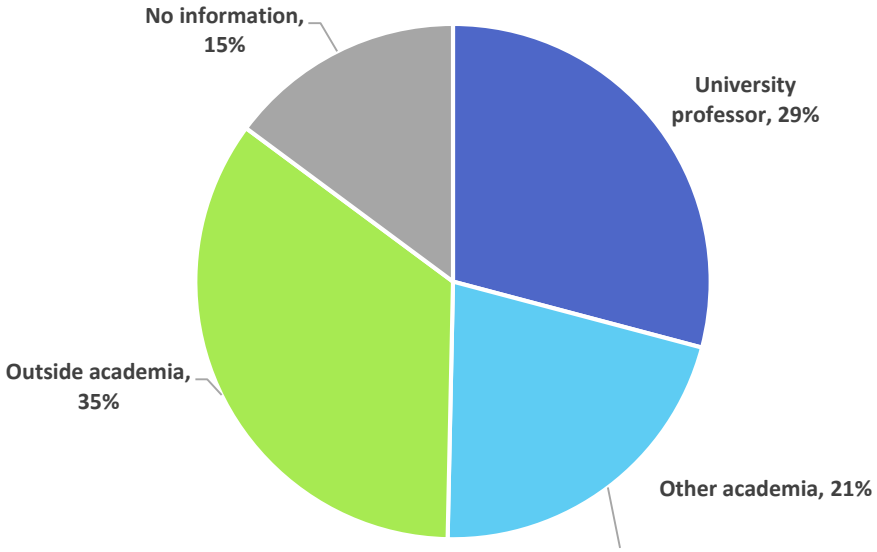
Overview of Employment Outcomes

Figure 4 reveals where Ontario's PhD graduates from 2009 are employed in 2015. Half of our graduates are employed in academia. Twenty-nine percent are employed as a university professor. This includes graduates who are working in a full-time tenure or tenure-track ranked academic position at a university (assistant, associate, full professor or equivalent). Another 21% have other jobs within academia – jobs like researchers, lecturers, college instructors and administrators. Thirty-five percent are working outside academia. For the remaining 15% for whom we were unable to find employment information, we hypothesize that they are likely employed outside the postsecondary sector, unemployed or out of the labour force entirely.[8] Universities around the world have well-developed web sites and typically

[8] Results from the NGS indicate that 6% of doctoral graduates from Ontario in 2009-10 were unemployed and 4% were out of the labour force three years after graduation.

post staff directories and other information about faculty and employees, and this makes us confident that we have captured all or almost all graduates who are working inside academia.

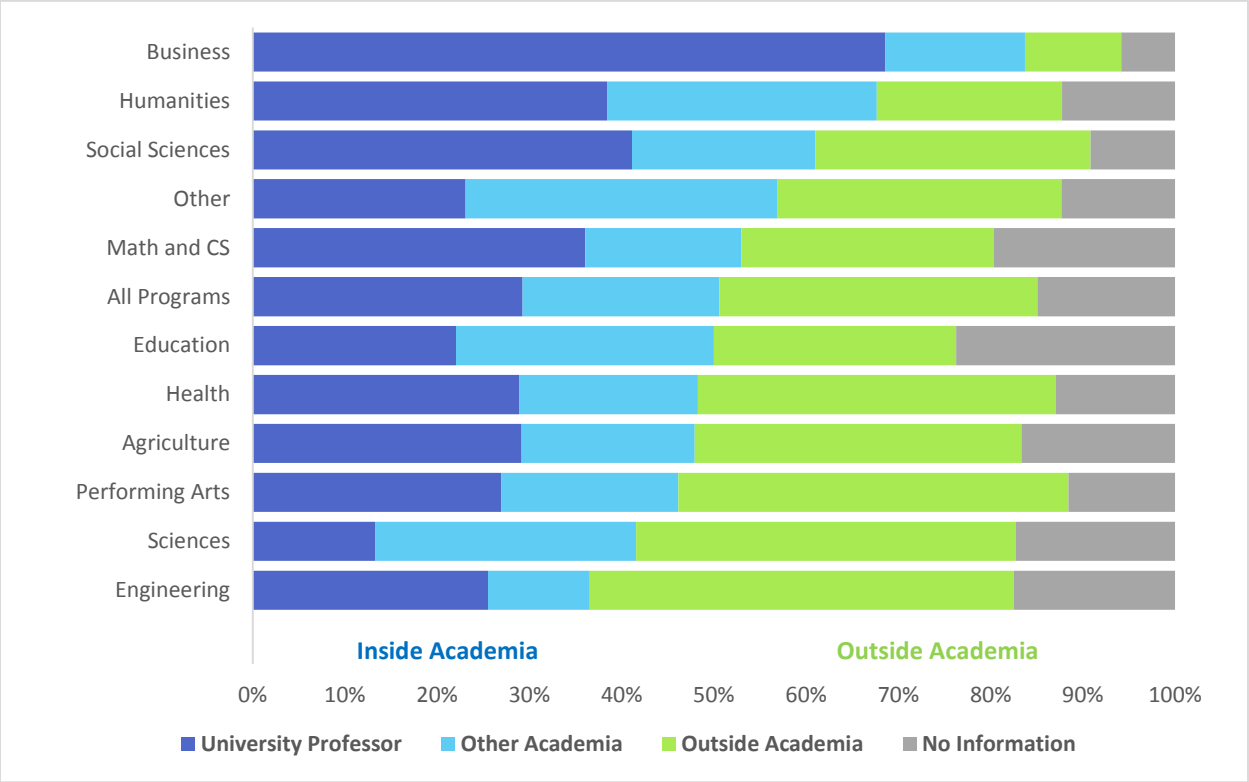
Figure 4: Where are Ontario's PhD Graduates from 2009 Employed?



Employment by Field of Study

There is a higher share of graduates from business, humanities and social sciences that is employed within academia and a higher share of graduates from engineering, science, health and performing arts that is employed outside academia. The following figure highlights differences in type of employment by field of study.

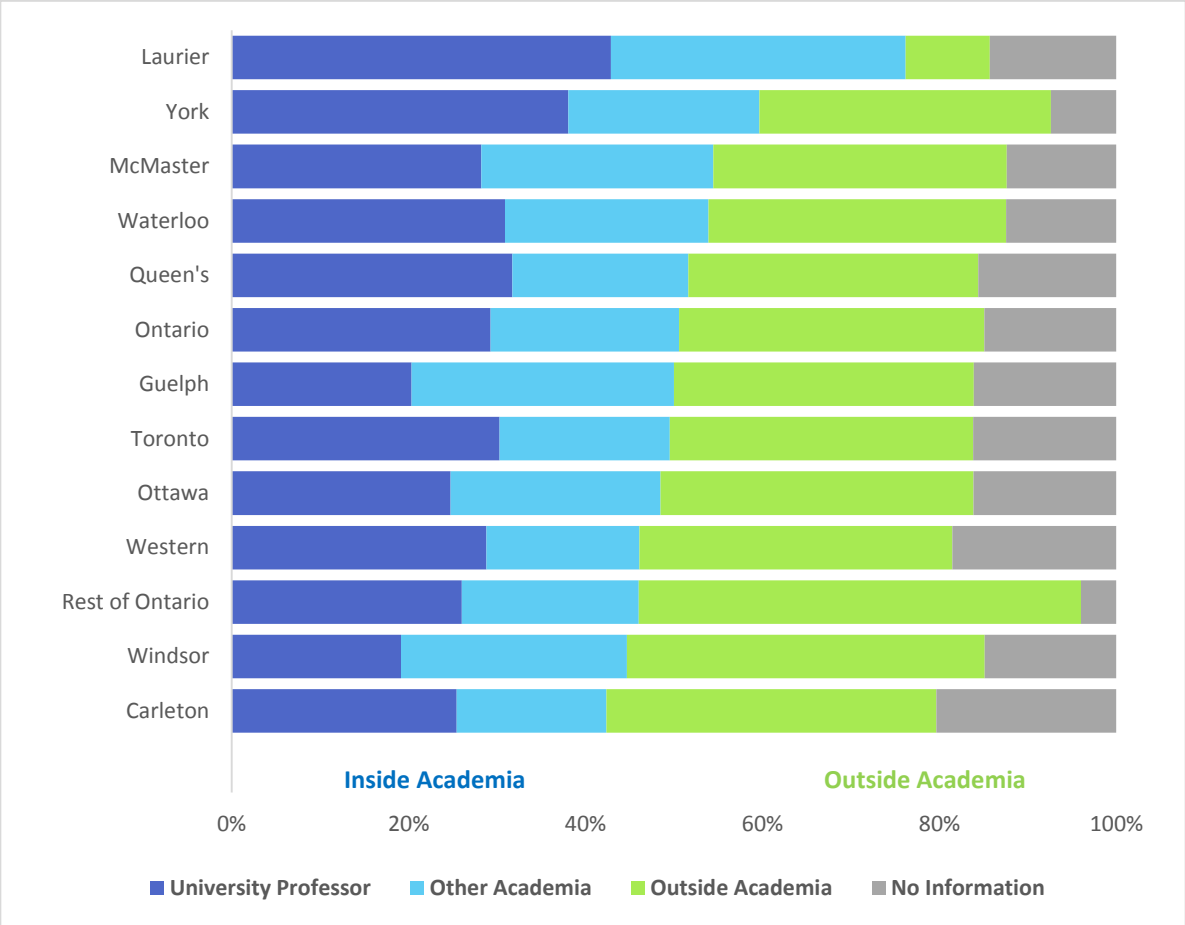
Figure 5: Employment by Field of Study



Employment by University

The following graph examines differences in employment based on the university where the PhD was awarded. There is a higher share of graduates from Laurier and York that is employed in academia compared to graduates from Carleton, Windsor and the Rest of Ontario grouping.

Figure 6: Employment by University



Note: Rest of Ontario includes Brock, Lakehead, Laurentian, Ryerson and Trent

Employment by Gender

There are slight differences between the proportion of males and females employed inside and outside academia. While females are more likely to be working within academia, there is a slightly higher proportion of males working as a university professor. The table below shows a summary of employment type by gender.

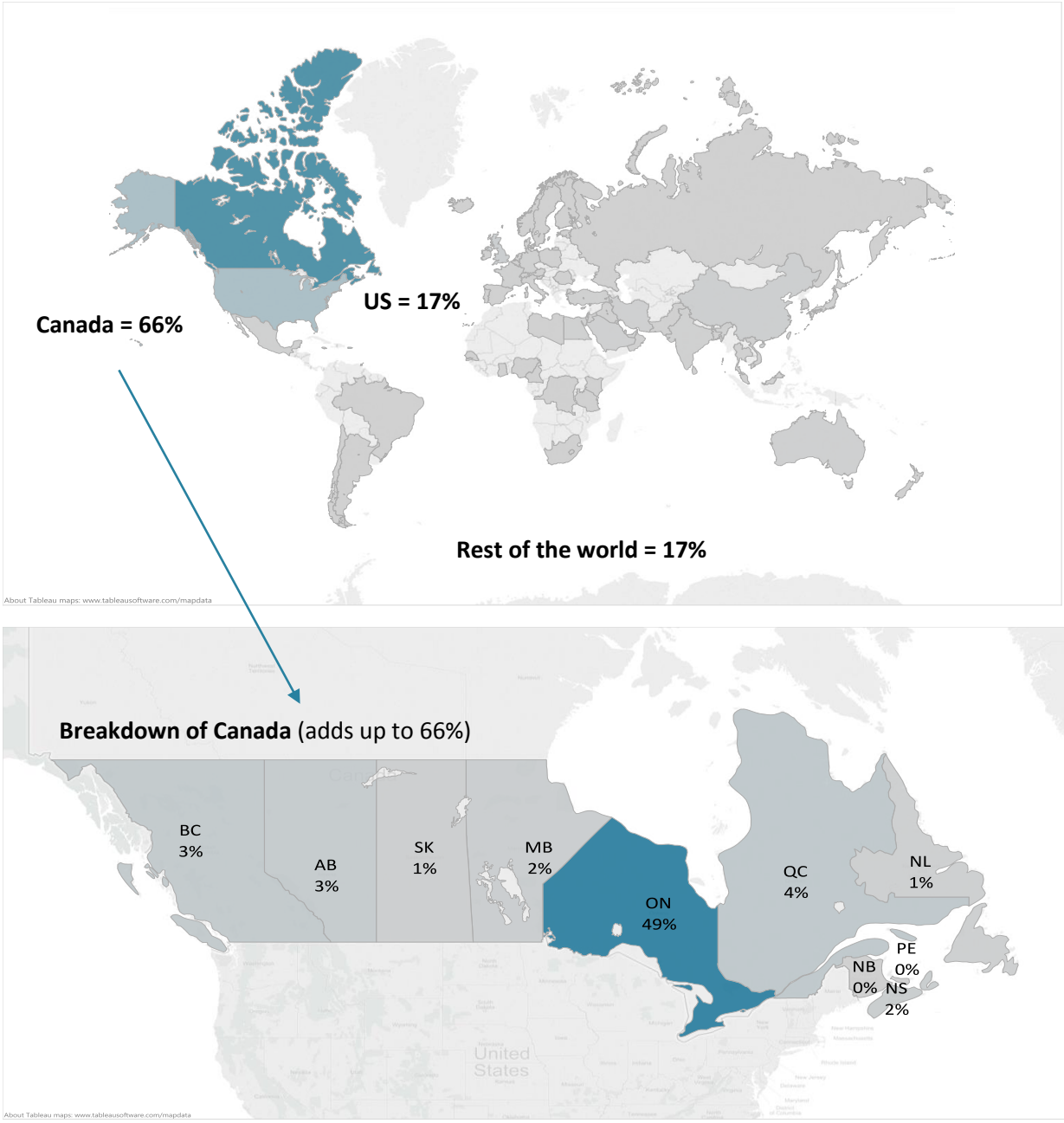
Table 3: Employment by Gender

	University professor	Other academia	Outside academia	No information
Females	29%	26%	33%	12%
Males	33%	19%	35%	13%
Unknown	6%	9%	38%	46%
All graduates	**29%**	**21%**	**35%**	**15%**

Employment by Country

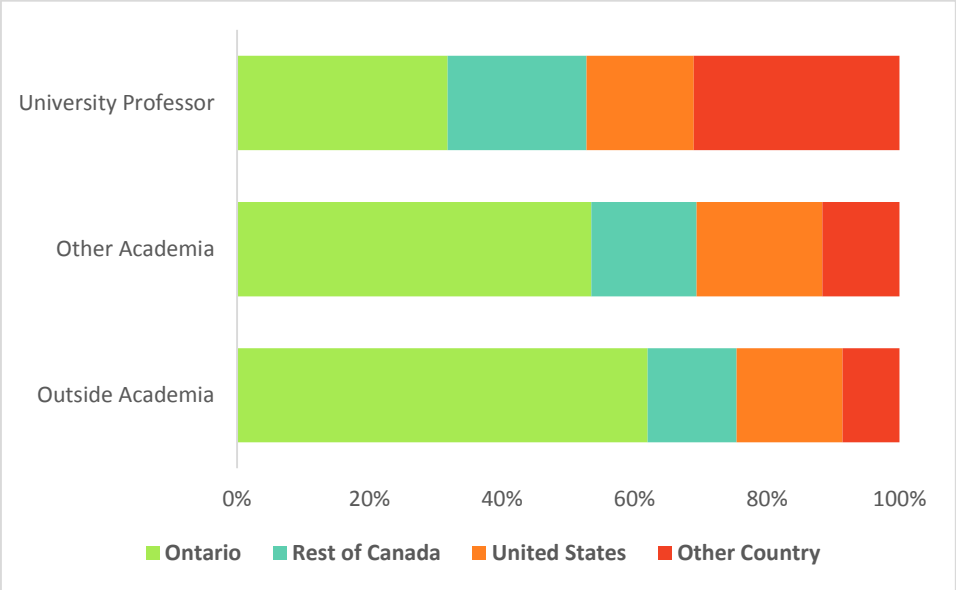
Of the 2,310 Ontario PhD graduates of 2009, just under half are currently working (either inside or outside academia) in Ontario. Of the remaining half, equal shares are working in another province within Canada, or in the United States, or in another country around the world. The following figure provides a detailed overview of country of employment.

Figure 7: Employment by Country



Graduates who are employed outside academia are more likely to be working within Canada compared to graduates who are employed as a university professor.

Figure 8: Employment by Country and Sector/Occupation



Part C: Additional Analysis of Employment Outcomes

This section contains additional analysis relating to the three categories of PhD employment.

- For professors, we explore the locations and prestige of the universities that hired them.
- For graduates with other jobs inside academia, we analyze the types of roles they perform and whether there are differences by field of study.
- For graduates with jobs outside academia, we examine industry of employment in more detail and identify the most common employers that hired Ontario's PhD graduates from 2009.

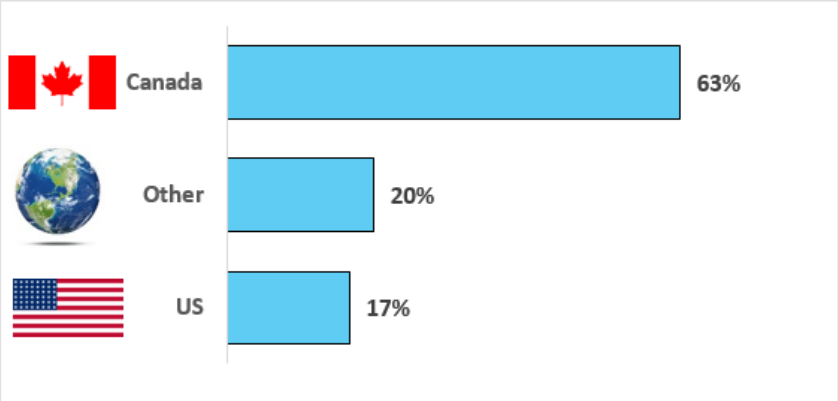
University Professors

As we have seen, 29% of Ontario's class of 2009 PhD graduates is currently employed as a full-time tenure or tenure-track professor at a university. In this section of the report, we examine in more detail the place of employment of these graduates.

First, we examined the extent to which graduates from the class of 2009 are employed at top-ranked universities. We classify a postsecondary institution as a top-ranked university in the world if it appeared in one of the top 50 rankings from either the Times Higher Education World University Rankings, QS World University Rankings or Academic World University Rankings over the past five years (2011 to 2015).

Of the 673 graduates who are employed as professors, 75 (11%) are working at a top-ranked university. Most of them (63%) are still in Canada, working at one of the three Canadian universities included in the top 50 – the University of Toronto, McGill and the University of British Columbia. Seventeen percent of the graduates working at top-ranked universities are at American universities and 20% are in other parts of the world. Figure 9 shows the global geographic distribution of where the 75 top professor graduates are working.

Figure 9: Locations where Professor-Graduates at a Top University are Employed



Of the 75 professor-graduates now working at top-ranked universities, Figure 10 shows that the majority graduated from the University of Toronto or from one of Ontario's research-intensive universities (McMaster, Ottawa, Queen's, Waterloo and Western). In Figure 10, we have again applied the colour coding associated with our four clusters of universities (though there are no graduates from the "mostly undergraduate" cluster of Ontario universities whose graduates are currently working at a top-ranked university).

Figure 10: Where Professor-Graduates Working at a Top University Earned their PhD

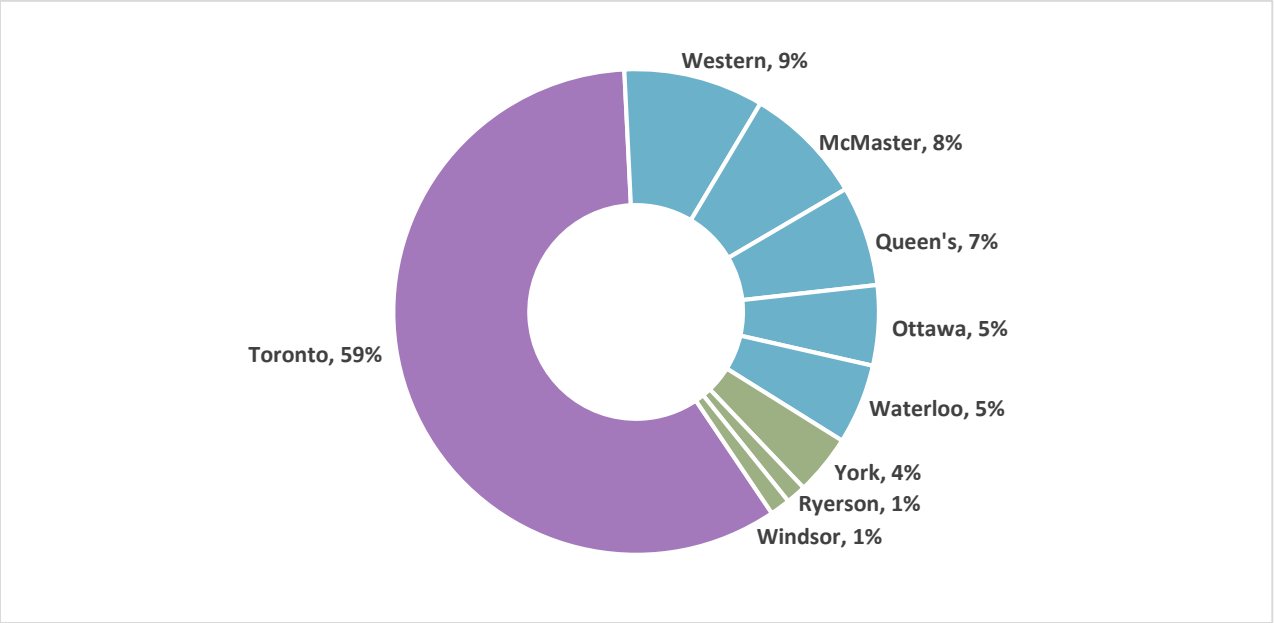


Table 4 shows the locations of the universities around the world that have hired our professor graduates. The universities are sorted based on the percentage of their professor-graduates who are working at a university outside Canada (from highest to lowest). There is a higher share of professor-graduates from Ontario's research-intensive universities who are working as professors outside Canada. Professor-graduates from Ontario's mostly undergraduate universities are primarily working within Canada and a larger proportion of them are working at the same university at which they earned their PhD. For ease of reference, we have colour-coded the Ontario universities in accordance with the clusters shown earlier.

Table 4: Location of Professor-Graduates by Ontario University that Awarded the PhD

	# of PhDs	PhD graduates working as university professors						
		# of university professor graduates		Location of employment for university professor graduates				
		Total	# Working at a top university	% at the same university that awarded the PhD	% rest of Ontario	% rest of Canada	% in the United States	% in another country
Windsor	47	9	1	11%	0%	0%	44%	44%
Waterloo	217	67	4	6%	19%	13%	9%	52%
Guelph	118	24	0	4%	25%	17%	13%	42%
Western	245	70	7	11%	19%	21%	16%	33%
Toronto	727	219	44	11%	21%	20%	26%	22%
Queen's	186	59	5	8%	20%	24%	19%	29%
Ottawa	200	49	4	14%	2%	37%	6%	41%
McMaster	203	57	6	14%	25%	19%	11%	32%
York	176	67	3	7%	31%	21%	4%	36%
Carleton	119	30	0	10%	27%	23%	20%	20%
Rest of Ontario	51	13	1	31%	23%	23%	0%	23%
Laurier	21	9	0	33%	44%	22%	0%	0%
Ontario	**2,310**	**673**	**75**	**11%**	**21%**	**21%**	**16%**	**31%**

Note: Ryerson is classified as an "in between" university, but due to small sample sizes it is grouped under the Rest of Ontario category with Brock, Lakehead, Laurentian and Trent.

With regard to gender, we showed in the previous section that there is a slightly higher proportion of male graduates employed as a university professor (33%) compared to females (29%).

Focusing on Ontario, we find that there is an equal number of 2009 male (N=107) and female (N=107) graduates who have been hired as a professor at an Ontario university.

Overall, female professor-graduates are more likely to be working in Ontario or the rest of Canada compared to males. The below table shows the share of where male and female professors are working.

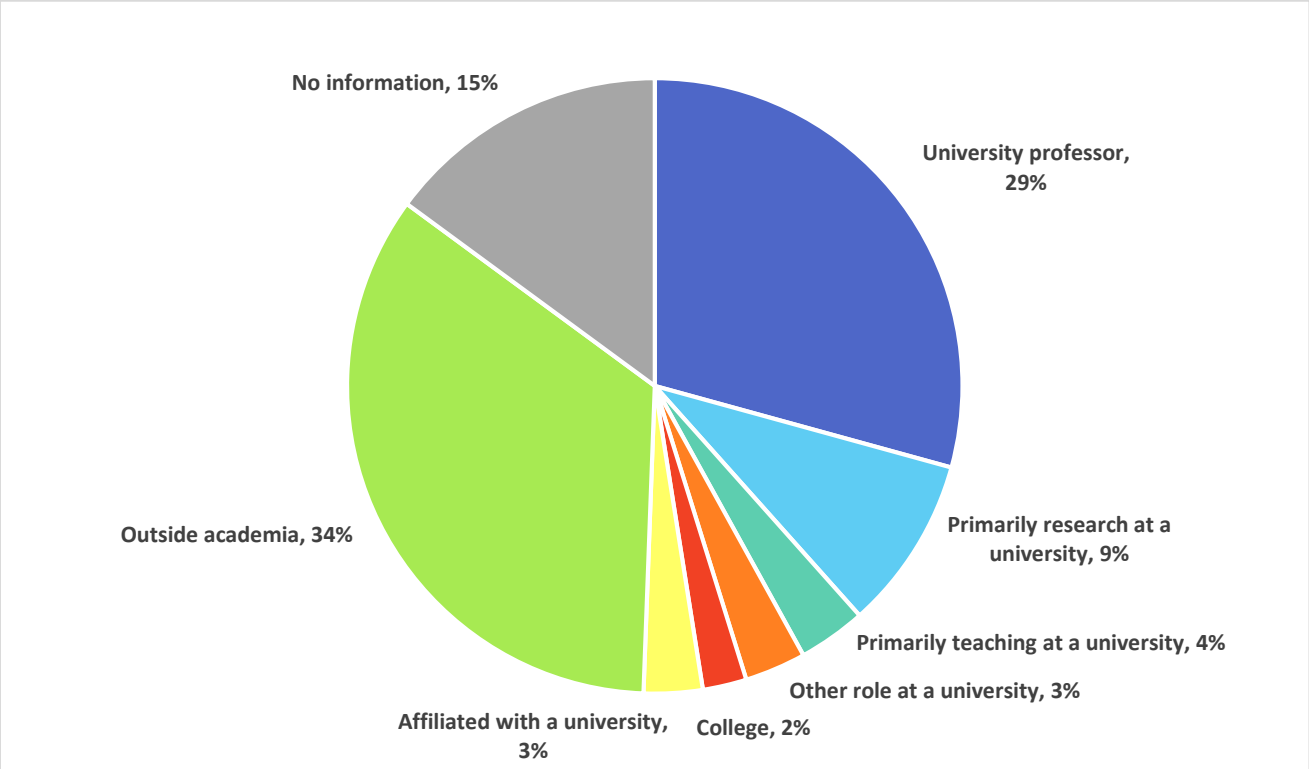
Table 5: Employment by Location and Gender for University Professors

	Ontario	Rest of Canada	US	Other
Female	38%	24%	17%	21%
Male	28%	19%	16%	37%
All graduates	**32%**	**21%**	**16%**	**27%**

Other Jobs in Academia

Twenty-one percent of Ontario's PhDs from 2009 are working in other jobs inside academia. The following figure provides a breakdown of these roles.

Figure 11: Types of Employment inside Academia



Notes about the categories:

Primarily research includes the following: postdoctoral fellows, research associates, research fellows, scientists, researchers and research professors.

Primarily teaching includes the following: teaching professors, lecturers (full-time and part-time), sessionals, instructors, laboratory coordinators and course directors.

Other includes administrative roles (such as the director of a center, program or lab), librarians, technical support staff, and academic roles with some expectation of both teaching and research that are not tenure-track (such as a visiting professor or an adjunct assistant professor).

Affiliated includes clinical professors, status-only professors, and lecturers or adjuncts who are teaching at an institution but have a job outside a postsecondary institution.

College includes any job (full-time or part-time) in a college or community college-equivalent institution.

The following table provides a detailed summary by field of study. The humanities, sciences, education and other (which includes multidisciplinary studies) have the highest percentage of graduates employed in other jobs within academia. There is a higher share of PhD graduates from the sciences, agriculture and multidisciplinary studies (other) who are working in a primarily research position at a university (19% of all science graduates, 17% of agriculture graduates and 14% of multidisciplinary graduates). The humanities have the highest share of graduates working in a primarily teaching position at a university (13% of all humanities graduates). Education has the highest share of graduates who are now employed at a college (10% of all education graduates).

Table 6: Percentage of Graduates Working in Other Jobs Inside Academia by Field of Study

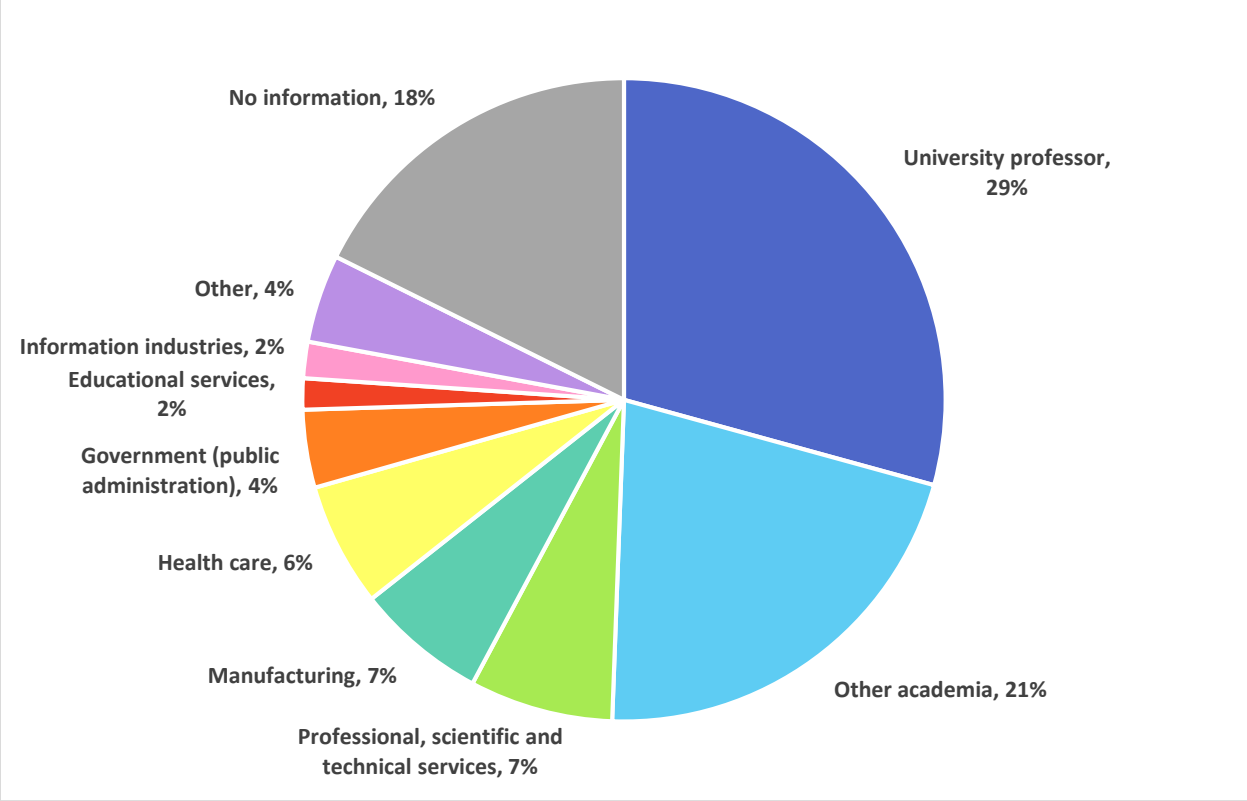
	% With other jobs inside academia	Other jobs inside academia				
		Primarily research	Primarily teaching	College	Affiliated	Other
Other	34%	14%	3%	3%	8%	6%
Humanities	29%	3%	13%	4%	2%	7%
Sciences	28%	19%	3%	2%	2%	3%
Education	28%	1%	6%	10%	3%	8%
Social sciences	20%	7%	5%	2%	4%	3%
Health	19%	7%	2%	3%	6%	2%
Performing arts	19%	4%	0%	8%	8%	0%
Agriculture	19%	17%	0%	2%	0%	0%
Math and CS	17%	8%	3%	1%	1%	4%
Business	15%	3%	1%	0%	7%	3%
Engineering	11%	7%	1%	1%	2%	1%
All Programs	**21%**	**9%**	**4%**	**2%**	**3%**	**3%**

Outside Academia

Thirty-five percent of Ontario's PhD graduates from 2009 are employed outside academia. We matched their employer information with the North American Industry Classification System (NAICS) to examine industry of employment in more detail. NAICS was developed in partnership between Canada (Statistics Canada), the United States (Economic Classification Policy Committee) and Mexico (Instituto Nacional de Estadística y Geografía) and provides consistency among the industrial structures of these three countries. Please refer to Appendix 2 for more information about the NAICS system.

Figure 12 provides an overview of employment by industry. The largest industries that employ Ontario's PhD graduates from 2009 (outside academia, and by definition therefore not including higher education) are: professional, scientific and technical services (includes services in engineering, computer systems design, consulting and scientific research), manufacturing, health care and government. Educational services includes elementary and secondary schools. The "other" category includes an aggregation of other industries (such as agriculture, mining, construction, retail trade and transportation) that employ a small percentage of graduates. The unknown category contains the 15% of graduates for whom we were unable to find employment information and an additional 3% of graduates whose employer could not be matched up using the NAICS system. These graduates are therefore added to the unknown category for the purposes of Figure 12.

Figure 12: Industry of Employment



The following table provides a list of the most commonly occurring employers outside academia of Ontario's PhD graduates from 2009. These employers collectively employed 101 of Ontario's PhD graduates from 2009. This represents 13% of all graduates who are working outside academia.

Table 7: Most Common Employers outside Academia

• Agriculture and Agri-Food Canada	• Microsoft
• Apple	• National Research Council Canada
• Bank of Montreal	• Public Health Agency of Canada
• Canadian Food Inspection Agency	• Qualcomm
• Environment Canada	• Scotiabank
• Google	• Self-employed
• Health Canada	• Statistics Canada
• Huawei	• University Health Network

The following table examines the industries that employ Ontario's graduates by field of study. There is a higher percentage of graduates from engineering, performing arts, science and health who are employed outside postsecondary education compared to graduates from business, humanities and social sciences. Engineering graduates working outside academia are mostly employed in manufacturing or "professional, scientific and technical services." Science graduates working outside academia are mostly employed in health care, manufacturing, public administration (government) and "professional, scientific and technical services."

Table 8: Percentage of PhD Graduates Employed Outside Academia by Field of Study

	% with jobs outside academia	Jobs outside academia						
		Professional and scientific services	Manu-facturing	Health care	Gov't	Educational services	Info	Other
Engineering	46%	12%	17%	1%	3%	1%	4%	7%
Performing arts	42%	0%	0%	0%	0%	8%	4%	31%
Sciences	41%	9%	10%	8%	7%	1%	1%	5%
Health	39%	7%	6%	18%	3%	0%	0%	4%
Agriculture	35%	4%	6%	2%	8%	0%	0%	15%
Other	31%	6%	3%	3%	8%	2%	0%	9%
Social sciences	30%	4%	1%	11%	5%	2%	1%	7%
Math and CS	27%	7%	3%	1%	1%	0%	4%	13%
Education	26%	4%	0%	5%	2%	10%	2%	3%
Humanities	20%	3%	0%	1%	1%	3%	1%	10%
Business	10%	5%	0%	3%	0%	0%	0%	2%
All programs	**35%**	**7%**	**7%**	**6%**	**4%**	**2%**	**2%**	**7%**

There are also slight differences in industry of employment for males and females. Overall, 35% of male graduates are working outside academia compared to 33% of females. There is a higher proportion of

males employed in professional, scientific and technical services, as well as manufacturing, and there is a higher proportion of females employed in health care.

Table 9: Industry of Employment by Gender

	% with jobs outside academia	Professional and scientific services	Manu-facturing	Health care	Gov't	Educational services	Info	Other
Males	35%	9%	8%	5%	3%	1%	2%	7%
Females	33%	6%	4%	9%	4%	2%	1%	7%
All graduates	**35%**	**7%**	**7%**	**6%**	**4%**	**2%**	**2%**	**7%**

Conclusion

The jobs our 2,310 PhD graduates from Ontario's universities hold today, six years after graduation, appear to be the very kinds of jobs we hoped for in return for the investment they and we made in their education. They are professors, scientists, engineers, public servants, health care professionals, working in the manufacturing sector and self-employed.

Ontario's 2009 PhDs are working both within the academy (50%) and in the greater private and public sector (35%). We observe considerable differences between fields of study. There is proportionally more employment outside the academy for STEM and health graduates (40%) than humanities graduates (20%). There are also more STEM and health PhDs being graduated in Ontario (61% of our cohort) than humanities PhDs (10%). We cannot project the optimal balance, overall or for individual fields of study. We simply observe that as governments and institutions worked together over the last decade to increase PhD enrolments they had both goals in mind (jobs inside the academy to renew the faculty and jobs outside academy to support the greater economy), and we see both goals reflected in the outcomes achieved by our study cohort.

Of those inside the academy, three out of five are part of the full-time tenure-track professoriate. The remaining two-fifths hold a variety of jobs, full- and part-time, at universities and to a small degree at colleges.

For those working outside the academy, our study identifies the industries in which they work. We could not, however, tell whether their PhD is advantaging them and their employers over the level of contribution made by other employees without PhD credentials. Are PhDs working on and adding value to advanced, innovative, leading products and projects? A follow-up study to ask employers whether they perceive a premium return from their PhD employees would help fill this gap.

Our PhDs are deployed around the globe. Those who are hired as professors, in particular, are working across Canada, in the United States and in countries in every continent. We recognize that this cuts both ways: we want our graduates to be internationally competitive and to take Ontario out into the world, but we also want them to stay in Ontario and lend their talents back to us. Our study could not identify

how many of our graduates are international students or what is the net flow of international students in and PhD graduates out of Ontario. This could be determined by integrating institutional administrative data and would make a useful follow-up study.

In our earlier research on the diversity of Ontario's universities, we identified seven research-intensive institutions (Toronto, Guelph, McMaster, Ottawa, Queen's, Waterloo and Western). In this study, we observe that 82% of our PhD cohort graduated from these seven universities. Their graduates are more globally mobile. They also produced 93% of the graduates who have accepted academic appointments at the world's top-ranked universities. By contrast, the five smallest producers of PhD graduates were averaging 10 graduates each in 2009, and their professor-graduates were more likely to be hired at the same university that graduated them.

These observations beg the question of whether the province should be focusing growth in PhD enrolment on the research-intensive leaders. The evidence suggests that this is not happening. The number of Ontario universities graduating PhDs has expanded from 14 in 2007 to 16 in 2009 to 17 today. The overall number of PhD graduates in Ontario has increased by 4.3% from 2009 to 2014 (from 2,310 to 2,409[9]), but the proportion graduating from our research-intensive universities has remained unchanged.

[9] Source for 2014 total: Council of Ontario Universities, Common University Data of Ontario (CUDO)

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Appendix 1: Field of Study Classifications

The table below provides a more detailed breakdown of the field of study classification and includes examples of how certain programs were categorized.

Table 9: Field of Study Overview

CIP – Primary Grouping	Program Examples
Education	Education
Visual and Performing Arts, and Communications Technologies	Art, art history, drama, music
Humanities	Classical studies, English, history, medieval studies, other languages, philosophy, religious studies, theology
Social and Behavioural Sciences and Law	Anthropology, communications, economics, geography, law, political science, psychology, sociology
Business, Management and Public Administration	Accounting, business, management
Physical and Life Sciences and Technologies	Astronomy, biochemistry, biology, chemistry, earth sciences, geology, molecular genetics, pharmacology, physics, physiology, zoology
Mathematics, Computer and Information Sciences	Mathematics, computer science, information science, statistics
Architecture, Engineering, and Related Technologies	Aerospace engineering, civil engineering, electrical engineering, mechanical engineering, software engineering
Agriculture, Natural Resources and Conservation	Animal and poultry science, environmental studies, food science, forestry, plant agriculture, plant sciences
Health and Related Fields	Dentistry, kinesiology, laboratory medicine and pathobiology, medical biophysics, medical sciences, pharmaceutical science, rehabilitation science
Other	Multidisciplinary studies

Appendix 2: Industry Classifications

Table 10: Overview of NAICS

NAICS Industry	Includes the following:
Professional, Scientific and Technical Services	Services in: accounting; computer systems design; consulting; engineering; legal; scientific research and development
Manufacturing	Manufacturing in: food; beverage and tobacco products; clothing; wood products; paper; printing; chemical, plastics and rubber products; primary metal; machinery; computer and electronic products
Health Care	Ambulatory health care services; hospitals; nursing and residential care facilities; social assistance (child daycare services; family services; community food and housing)
Public Administration	Federal, provincial/territorial and municipal government public administration
Other	Aggregation of the following sectors: agriculture, forestry, fishing and hunting; Mining, quarrying, and oil and gas extraction; utilities; construction; wholesale trade; retail trade; management of companies and enterprises; administrative and support, waste management and remediation services; transportation and warehousing; real estate and rental and leasing; finance and insurance; art, entertainment and recreation; accommodation and food services; other services (except public administration)
Educational Services	Elementary and secondary schools
Information and Cultural Industries	Publishing industries; broadcasting; telecommunications; data processing, hosting and related services